

JAPANESE

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CLAIMS DETAILED DESCRIPTION TECHNICAL
FIELD PRIOR ART EFFECT OF THE INVENTION
TECHNICAL PROBLEM MEANS EXAMPLE

[Translation done.]

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MEANS

[Means for Solving the Problem]If this invention persons make a carrier of an organic high polymer which has hydrophilic units support an antibacterial metallic component wholeheartedly as a result of examination in order to solve said technical problem, An antibacterial metallic component could be emitted according to humidity environment, it found out that it continues at a long period of time, and high antimicrobial activity can be maintained, and that an antibacterial resin composition with it was obtained, and this invention was completed. [high compatibility with an organic high polymer and] [useful as an antimicrobial coating agent etc.] That is, an antibacterial metallic component which comprised a metal ion or metallic compounds combines with a polymer particle chemically, and an antimicrobial polymer particle of this invention is

supported. In this antimicrobial polymer particle, an antibacterial metallic component is chemically combined with a polymer particle via a functional group which usually contains an oxygen atom, a nitrogen atom, and at least one atom chosen from a group which consists of sulfur atoms. Namely, a polymer particle which constitutes antimicrobial polymer, It comprises hydrophilic polymer which has the structure of cross linkage containing hydrophilic units, a unit which has a combinable functional group chemically to an antibacterial metallic component including at least one atom chosen from an oxygen atom, a nitrogen atom, and a sulfur atom, and a bridge construction unit. Mean particle diameter of a polymer particle may be 0.1 nm - about 100 micrometers. As said antibacterial metallic component, silver, platinum, copper, zinc, nickel, cobalt, molybdenum, chromium, etc. can be illustrated. A holding amount of an antibacterial metallic component is metal conversion, and is about 0.01 to 70% of the weight of the whole. Said antimicrobial polymer can be manufactured by joining together chemically and making a functional group of hydrophilic polymer particles which have the structure of cross linkage support an antibacterial metallic component which comprised a metal ion or metallic compounds. A resin composition of this invention contains said antimicrobial polymer particle and resin (binder resin etc.), and they can be used for it as an antibacterial coating resin composition etc. This antibacterial resin composition can be prepared by mixing said antimicrobial polymer particle and resin (binder resin etc.).

[0007]"Support" of an antibacterial metallic component as used herein means that an antibacterial metallic component is held the surface and/or inside a polymer particle, as long as antibacterial properties are revealed. It may use for a meaning including both sides of an ionic bond and a coordinate bond with a "chemical bond" and "chemical bonds", and may only be called "coordination."

"Hydrophilic polymer not constructing a bridge" and "hydrophilic polymer which has the structure of cross linkage" may only be named "hydrophilic polymer" generically.

[0008]

[Embodiment of the Invention][Hydrophilic polymer particles] The polymer particle comprises hydrophilic

polymer which has a functional group which an antibacterial metallic component can configure, and may be any of synthetic macromolecule and naturally-occurring polymers. Hydrophilic polymer particles have the structure of cross linkage, and are usually poor solubility or insolubility to a solvent. The hydrophilic polymer particles which function as a carrier contain at least one atom chosen from hydrophilic units, an oxygen atom and a nitrogen atom, and the sulfur atom, And it comprises a ligating property unit which has a combinable functional group (especially ligating property group) chemically to an antibacterial metallic component, and a bridge construction unit. In hydrophilic polymer particles, hydrophilic units and the ligating property unit which has a functional group may be of the same kind, or may differ from each other.

[0009] Various hydrophilic fragmentation and segments can be used as hydrophilic units, For example, By hydrolysis of carboxyl group content unit [(meta) unit formed by carboxyl group or acid anhydride group content monomers, such as acrylic acid and maleic anhydride,] hydroxyl content unit [vinyl acetate. Unit] formed by hydroxyl content monomers to generate, such as a vinyl alcohol unit and hydroxy C₂₋₃ alkyl (meta) acrylate, Ether group content unit [vinyl C₁₋₄ alkyl ether, Unit] in which polyethylene-glycol mono- ** was formed by ether group content monomers, such as di (meth)acrylate and a polyethylene glycol, A nitrogen content unit [unit formed by nitrogen content monomers, such as vinyl pyrrolidone, vinylpyridine, acrylamide (meta), methylol(meta) acrylamide, and N,N-dialkylamino alkyl (meta) acrylate,] etc. can be illustrated. Hydrophilic polymer may have several different hydrophilic units, and hydrophilic units may form a salt as occasion demands.

[0010] They are contained in desirable hydrophilic units by the hydrophilic units which form water-soluble polymer and have compatibility to hydrophobic resin, and as such hydrophilic units, The unit (for example, hydrophilic units formed with acrylamide (meta), N-substitution (meta) acrylamide, etc.) containing a nitrogen atom (especially an amide group or N-substituted amide group) can be illustrated. As N-substitution (meta) acrylamide, for example N-C₁₋₆ alkyl (meta) acrylamide, such as N-methyl (meta) acrylamide, N-ethyl(meta) acrylamide, and N-butyl

(meta) acrylamide, N-C₁₋₆ acyl (meta) acrylamide etc. can be illustrated. If hydrophilic units are formed with N-C₁₋₆ alkyl (meta) acrylamide, such as N-butylacrylamide, it can give temperature sensitive to a polymer particle.

[0011] In a ligating property unit, as a functional group (especially ligating property group) containing an oxygen atom, For example, a carboxyl group or its derivative group (an acid halide group, an acid anhydride group, etc.), Hydroxyl, an acyl group (C₁₋₄ acyl groups, such as formyl and an acetyl group etc.), A carbonyl group, a poly carbonyl group including acetylacetone structure, an ether group, A crown ether group, aromatic polyhydroxyl including catechol structure, an aromatic hydroxy carbonyl group including salicylic acid structure, a polycarboxylic acid group including phthalate structure, an epoxy group, oxygen content heterocycle groups (a furil group, a chromanyl group, etc.), etc. can be illustrated.

[0012] As a functional group (especially ligating property group) containing a nitrogen atom, An amino group and mono- ** For example, a dialkylamino group (a mono- C₁₋₄ alkylamino group, a II C₁₋₄ alkylamino group, etc.), azo, an amidino group, a hydrazino group, a hydrazono group, a cyano group, and a nitrogen content heterocycle group (a pyrrolyl group and an imidazolyl group.) Azacrown ether groups, such as a pyridyl group, a bipyridyl group, a pyrrolyl group, a piperidinyll group, a piperazinyl group, a quinolyl group, a benzimidazolyl group, and a phenan SURORIRU group, etc. can be illustrated. As a nitrogen content functional group, an amino group and an imino group may be used in many cases, and nitrogen content functional groups may be heterocycle groups, such as a pyridyl group.

[0013] As a functional group (especially ligating property group) containing a sulfur atom, A sulfhydryl group (thiol group), a thioxo group, a thienyl group, a thioacetyl group, An alkyl thionyl group, a thiocarbamoyl group, a sulfonyl group, a thiocarboxyl group, A sulfonic group (sulfonic group), a sulfinic acid group (sulfinic group), a thiourea group (thio ureido group), a thia crown ether group, a thioether group, heterocycle groups (thiophenyl group etc.), etc. can be illustrated.

[0014] Hydrophilic polymer particles may have a functional

group containing the functional group which has two or more atoms chosen from an oxygen atom, a nitrogen atom, a sulfur atom, etc., for example, an oxygen atom, and a nitrogen atom. As such a functional group, an amino alcohol group like a nitro group, an ureido group, and an amino hydroxyethyl group for example, An aminophenol group, a KINORINO group, an amino-polycarboxylic-acid group like an IMIJINO acetic acid group, an oxime group, an amide oxime group, heterocycle groups (a morpholino group, a morpholinyl group, etc.), etc. can be illustrated.

[0015]Two or more above-mentioned functional groups are combinable. Since the strength of combination with a metal ion or metallic compounds changes with kinds of functional group, discharge of the antibacterial metallic component from hydrophilic polymer particles is controllable by using combining the functional group from which a kind differs two or more.

[0016]The kind of functional group can be chosen according to the kind of antibacterial metallic component. An oxygen content functional group [for example, carboxyl group] etc., a nitrogen content functional group [for example, nitrogen content heterocycle groups (imidazolyl group, pyridyl group, bipyridyl group, etc.) etc.], and a sulfur content functional group [thiol group, thio ureido group], etc. are contained in a desirable functional group. If such a functional group and an antibacterial metallic component (for example, silver ingredient) are combined, a complex can be formed effectively.

[0017]The bridge construction unit for introducing the structure of cross linkage into hydrophilic polymer particles may be constituted from a condensation nature group or fragmentation like self-crosslinked polymer particles (for example, hardening or a cross linked particle of thermosetting resin, etc.), and may consist of cross linking agents. Like [heat resistance of a crosslinked polymer particle is high, and] a baking coating, even if exposed to an elevated temperature (for example, about 300 **), high tolerance is shown. As a cross linking agent which constitutes a bridge construction unit, a polymerization nature unsaturated monomer by the polymer (vinyl polymerization type polymer) used as a raw material. Usually, polyfunctional polymerization nature monomer [divinylbenzene, methylenebis (meta) acrylamide, Ethylene

glycol di(metha)acrylate, diethylene GURIKORUJI (meta) acrylate,], such as propyleneglycol di(meth) acrylate, dipropylene GURIKORUJI (meta) acrylate, TORIMECHI roll pro pantry (meta) acrylate, penta ERIS RITORUTORI, or tetra (meta) acrylate, is used.

[0018]In the hydrophilic polymer (a condensed type or addition condensation type polymer) which uses condensation or an addition reaction nature monomer as a raw material, the compound which has two or more reactive functional groups to the functional group of polymer can be used as a cross linking agent. When hydrophilic polymer has two or more carboxyl groups or acid anhydride groups, as a cross linking agent, For example, the epoxy compound which has an epoxy group of polyvalent-metal-ion (magnesium ion, Al ion, zirconium ion, etc.); polyisocyanate; polyamine; plurality; a screw oxazoline compound etc. are mentioned. When hydrophilic polymer has hydroxyl, as a cross linking agent. for example, polyisocyanate; polyvalent carboxylic acid or its reactive derivative (acid halide.) acid anhydride; -- the compound (dichlorodimethylsilane.) which has a hydrolytic silyl group The compound which has the methylol group or alkoxy methyl groups of; plurality, such as dichloro tetramethyl disiloxane, methyl trimetoxysilane, and methyl triethoxysilane (urea resin, melamine resin, etc.); a screw oxazoline compound etc. are mentioned. The epoxy compound which has an epoxy group of compound; plurality which has polyisocyanate; polyvalent carboxylic acid or its reactive derivative; hydrolytic silyl group, for example when hydrophilic polymer has an amino group, an amide group, etc.; a screw oxazoline compound etc. can use it as a cross linking agent.

[0019]The degree of cross linking of hydrophilic polymer particles is bridge construction unit (or cross linking agent) conversion, and is about 1 to 10 % of the weight more preferably 0.5 to 20% of the weight 0.1 to 30% of the weight, for example.

[0020]Said ligating property unit (for example, unit formed by the monomer containing nitrogen content groups, such as said carboxyl group and a nitrogen content heterocycle group, a sulfhydryl group, etc.) which has ** hydrophilic nature to the hydrophilic polymer particles which have the structure of cross linkage, A copolymer or a co-

condensation product with a bridge construction unit (for example, unit formed by cross-linking monomers and cross linking agents, such as a polyfunctional polymerization nature monomer), ** Said hydrophilic units (meta) (unit formed by monomers, such as acrylamide and N-substitution (meta) acrylamide), The copolymer or co-condensation product of said ligating property unit (for example, unit formed by the monomer containing said carboxyl group, a nitrogen content functional group, a sulfhydryl group, etc.) and a bridge construction unit (for example, unit formed by a polyfunctional polymerization nature monomer etc.) is contained.

[0021]Further these hydrophilic polymer particles as a copolymerization unit. For example, vinyl ester system monomers, such as aromatic vinyl monomers, such as acrylic system monomers (meta), such as acrylic acid alkyl ester (meta) and acrylonitrile (meta), and styrene, and vinyl acetate, The unit formed by olefins, such as containing halogen monomers, such as polyvinyl chloride and a polyvinylidene chloride, ethylene, and propylene, etc. may be included, and as long as it is required, it may denaturalize further.

[0022]The cross linked polymer in which desirable hydrophilic polymer particles have hydrophilic polymer gel [, for example, a ligating property unit, (bridge construction polyacrylic acid, bridge construction polyvinyl pyridine, etc.), An acrylamide unit and a ligating property unit. Cross linked polymer which it has (the structure of cross linkage.) The acrylamide which it has. (Meta) It can constitute from], such as an acrylic acid copolymer, an acrylamide vinylpyridine copolymer which has the structure of cross linkage, an acrylamide mercaptomethyl substitution styrene copolymer which has the structure of cross linkage, and an acrylamide (meta) acrylic acid-vinylpyridine copolymer which has the structure of cross linkage.

[0023]The concentration of the functional group (ligating property unit) of hydrophilic polymer particles can be chosen according to the holding amount of an antibacterial metallic component, for example, is about 0.1-5 millimols preferably 0.01 to 10 millimol per 1g of polymer particles. The amount used which is a monomer which has a ligating property unit can be chosen from about 25 to 100% of the weight of the range preferably [it is desirable and] to 10 to

100 % of the weight, and a pan five to 100% of the weight, for example.

[0024]In order to make the antimicrobial activity of an antibacterial metallic component reveal effectively, hydrophilic polymer particles may be porosity. the specific surface area of porosity particles -- 10-1000m²/g -- desirable -- 50-1000m²/g -- it is a 100-1000 m²/g grade still more preferably.

[0025]The shape of particle state hydrophilic polymer may be any, such as a globular shape, tabular, rod form, and petaloid. It may be dryness, for example, 0.1 nm - 100 micrometers, preferably, the mean particle diameter of hydrophilic polymer particles may be 5 nm - a 10-micrometer (especially 10-nm - 1 micrometer) grade more preferably, and may be about 10-500 nm 1 nm - 30 micrometers (for example, 1 nm - 5 micrometers). Although it can choose according to a use, if the polymer particle of nano size is used, the particle diameter of hydrophilic polymer particles can raise the content of the antibacterial metallic component in the dispersibility in a resin composition, and a resin composition, and can reveal high antibacterial properties with a small addition. The carrying state of the antibacterial metallic component to hydrophilic polymer particles (for example, by copolymerization etc.) The introduction to the polymer particle of several functional groups from which the ligating property to an antibacterial metallic component differs, etc., By controlling the grade (for example, [of a polymer particle / the hygroscopicity or swelling]) of mixing of two or more polymer particles which have a different functional group, and the hydrophilic nature of a polymer particle, according to ambient environment humidity etc., discharge of an antibacterial metallic component can be controlled and the antimicrobial agent of quick action thru/or durability can be obtained.

[0026][Antibacterial metallic component] To hydrophilic polymer particles, an antibacterial metallic component carries out a chemical bond, and is supported. In particular, the chemical bond of the antibacterial metallic component is carried out to hydrophilic polymer particles via said functional group (functional group containing an oxygen atom, a nitrogen atom, a sulfur atom, a phosphorus atom, etc.). These antibacterial metallic components are

independent, or an antibacterial metallic component can be constituted from the metal ion and metallic compounds which have antibacterial properties, and they can be used, combining them two or more sorts. As a metal ion which has antibacterial properties, a silver ion (silver (I) or (II) ion), platinum ion, a copper ion, zinc ion, nickel ion, cobalt ion, molybdenum ions, and chromium ions can be mentioned, for example. Desirable antibacterial metal ion is silver (I) ion, a copper ion and zinc ion, especially a silver ion.

[0027]As metallic compounds which have antibacterial properties, at least a kind of metallic compounds chosen from silver, platinum, copper, zinc, nickel, cobalt, molybdenum, and chromium can be illustrated, and the metallic compounds of reactivity or ligating property can usually be used to the functional group of said polymer. Said metallic compounds may be metal complexes and this metal complex may be anionic and cationic or neutral any. As for an opposite cation, in the case of an anionic complex, it is preferred that it is quaternary ammonium (phenyldimethyl alkylammonium, didecyl dimethylammonium, Sept Iles trimethylammonium, tetramethylammonium, etc.) which has antibacterial properties.

[0028]In desirable metallic compounds, a silver compound (AgCl, AgBr, etc.), for example, a silver halide, A halogen acid salt and a fault halogen acid salt (AgClO₄, AgClO₃, AgBrO₃, AgIO₃, etc.), Inorganic acid salts (silver sulfate, silver nitrate, silver carbonate, etc.), organic acid salt (silver acetate, oxalic acid silver, etc.), and complexes (a dicyano complex, a JICHIOSURU fight complex, a diammine complex, a dichloro complex, etc.) are contained. Said antibacterial metallic components (silver ingredient etc.) are configured to the functional group of said polymer, and may form complexes (a thiol complex, a thio ureido complex, a pyridyl complex, a bipyridyl complex, a phenanthroline complex, a histidyl complex, etc.). If the antibacterial metallic component which can be configured is used to the functional group of polymer, the content of an antibacterial metallic component can be increased, it continues at a long period of time, and antimicrobial activity can be maintained. Even if antimicrobial activity falls, it is easily renewable by being immersed in the solution

containing antibacterial metal ion.

[0029]The holding amount of an antibacterial metallic component should just be a range which does not spoil antibacterial properties, for example, is metal conversion, and the full weight of hydrophilic polymer particles is preferred 0.01 to 70% of the weight, and it is about 5 to 40 % of the weight one to 40% of the weight especially more preferably 0.1 to 50% of the weight.

[0030]In the desirable antimicrobial agent of this invention, for example Nitrogen content hydrophilic units, Ligating property units, such as an oxygen content functional group, a nitrogen content functional group, and a sulfur content functional group, The hydrophilic polymer particle with a mean particle diameter of 1 nm - 10 micrometers (for example, 1 nm - 3 micrometers, preferably 10-500 nm, especially about 50-500 nm) which have a bridge construction unit, It comprises an antibacterial silver ingredient supported by carrying out a chemical bond (especially coordinate bond) to said functional group of this polymer particle. In this antimicrobial agent, the holding amount of an antibacterial silver ingredient is silver conversion, and is a 1 to 50% of the weight of whole (preferably 5 to 40 % of the weight) grade. Hydrophilic polymer particles may contain the organic system antimicrobial agent further as occasion demands in order to improve antimicrobial activity.

[0031][Manufacturing method of an antimicrobial polymer particle] The antimicrobial agent of this invention can be prepared by joining together chemically and making the functional group of hydrophilic polymer particles support an antibacterial metallic component. Said hydrophilic polymer particle can be prepared using the method of common use of grinding and classification, suspension polymerization, an emulsion polymerization, etc. As the typical method of preparation of bridge construction hydrophilic polymer particles, The method of polymerizing the monomeric mixture which comprised a monomer corresponding to a ligating property unit, a monomer corresponding to hydrophilic units, and a cross linking agent for forming the structure of cross linkage can be illustrated using a polymerization initiator among the precipitate polymerizing method (it is a mixed solvent of water and a hydrophilic solvent especially), for example, a nonaqueous solvent. The

particle diameter of hydrophilic polymer particles can be controlled and the hydrophilic polymer particles which have the particle diameter of a nano order can be made to generate efficiently by adjusting the kind of hydrophilic solvent, and the rate of water and a hydrophilic solvent in this method. As a hydrophilic solvent, ether, such as ketone, such as alcohols, such as methanol, ethanol, isopropanol, and butanol, and acetone, dioxane, and a tetrahydrofuran, and these mixed solvents can be illustrated. the rate of water and a hydrophilic solvent -- former/latter = 1 / 99 - 70/30 (% of the weight) -- it can choose suitably [it is desirable and] from the range of 50/[3/97 -] 50 (% of the weight) grade. Especially in this precipitate polymerizing method, while being able to control the generated grain size, without using dispersion stabilizer, washing and recovery of particles are easy and hydrophilic polymer particles can be obtained by low cost.

[0032]Bridge construction hydrophilic polymer particles the solution of hydrophilic polymer containing the functional group which can configurate an antibacterial metallic component, How to add and harden a cross linking agent after carrying out addition mixing at a poor solvent and making a polymer particle generate in a medium, After carrying out addition mixing of the mixed liquor of a cross linking agent and hydrophilic polymer at the poor solvent to polymer and making a polymer particle generate in a medium, it can obtain by the method of hardening, the spray-drying method which carries out spray drying of the mixture of a cross linking agent and hydrophilic polymer, etc. The bridge construction hydrophilic polymer particles of the thermosetting resin which has self crosslinkability can be prepared like the above, without using a cross linking agent.

[0033]An antibacterial metallic component may originate in said monomer and cross linking agent used as the raw material of polymer, and may introduce the functional group in which a chemical bond is possible into the generated polymer using a polymeric reaction etc. As a method of introducing said functional group into polymer using a polymeric reaction, the method of common use according to the preparing method of metal ion adsorbent resin, such as chelating resin, is employable, for example. For example, a sulfhydryl group and a bipyridyl group can be introduced according to Ueyama, N, et al. Inorg. Chem. Acta. 89, and

the method indicated to 19-23 (1984). Introduction of an imidazole group can be performed by for example making histidine react to the polymer which has a chloromethyl group.

[0034]Support of the antibacterial metallic component to a polymer particle can be performed by swelling a polymer particle with a solvent as occasion demands, carrying out addition mixing of the solution containing an antibacterial metallic component for example, and carrying out the chemical bond of the antibacterial metallic component to polymer. After making an antibacterial metallic component support, polymer is washed and the antimicrobial polymer particle of this invention is obtained by drying.

[0035]Since an antibacterial metallic component and hydrophilic polymer particles are carrying out the chemical bond of the antimicrobial polymer particle of this invention, it continues at a long period of time, and it reveals high antimicrobial activity. Since it comprises hydrophilic polymer especially, under the high humidity environment in which these days and a microorganism breed easily, it absorbed water, particles swelled, and it becomes easy to emit the antibacterial metallic component inside particles, and has environmental response nature. In particular, in particles (for example, particles of nano size), distance until the antibacterial metallic component inside particles reaches a particle surface is short, and, moreover, can improve the contacting efficiency of an antibacterial metallic component, and bacteria and a microorganism according to increase of a particle surface product. It is also possible for the hydrophilic polymer particles to which antimicrobial activity fell to only be immersed in the solution (solution) containing an antibacterial metallic component, and to reproduce. An antibacterial metallic component can be supported stably, and even if it irradiates with ultraviolet rays etc., it does not discolor. And since a carrier is an organic high polymer, it is possible to form an antibacterial coating film with the dispersibility of a polymer particle for hydrophobicity and the compatibility to the both sides of a hydrophilic organic high polymer to be high, and high and high transparency. Therefore, antimicrobial polymer of this invention is useful although an antibacterial resin composition is constituted combining resin (for example, resin used for an ultraviolet curing nature paint or

distemper).

[0036][Antibacterial resin composition] In an antibacterial resin composition, resin can be chosen from the wide range according to a use. as resin -- thermoplastics [olefin system resin (polyethylene and polypropylene.) Polyethylene, denaturation polypropylene, etc. which denaturalized by carboxyl group, acid anhydride group, an epoxy group, etc., Acrylic resin (poly methyl methacrylate, carboxyl containing acrylic resin, a hydroxyl content acrylic resin, epoxy group containing acrylic resin, etc.), Styrene resin (copolymer of polystyrene, an AS resin, ABS plastics, styrene, and an acrylic (meta) monomer, etc.), Vinyl acetate system resin (polyvinyl acetate, an ethylene-vinylacetate copolymer, a vinyl acetate vinyl chloride copolymer, etc.), A vinyl alcohol system polymer (polyvinyl alcohol, ethylene-vinylalcohol copolymer, etc.), VCM/PVC system resin (polyvinyl chloride etc.) and polyester resin (polyalkylene terephthalate and polyalkylene naphthalate.)], such as polyurethane resin, such as copolymerized polyester resin and modified polyester resin, polyamide resin, and rubber, a thermosetting resin [epoxy resin, phenol resin, urethane resin, unsaturated polyester resin, vinyl ester resin, diallyl phthalate resin, silicone resin,] and photo-setting resin [epoxy (meta) acrylate, [, such as amino resin (urea resin, melamine resin, etc.)] Photoresist monomer [, such as photoresist oligomer, such as urethane (meta) acrylate and polyester (meta) acrylate, polyfunctional (meta) acrylate, and a nitrogen content monomer,]] etc. can be illustrated. These resin is independent, or it can be used, combining it two or more sorts. Resin may be water soluble resin and organic solvent soluble resin. Resin can be used as aqueous dispersion and non-aqueous dispersing elements (an emulsion, latex, etc.) (organosol etc.).

[0037]The antibacterial molding resin composition containing the molding resin in which the resin composition of this invention is used for molding processes, such as extrusion molding and injection molding, Although it is good in ***** containing resin for adhesives, it is preferred that it is a resin composition for coating containing resin for coating agents (binder resin), such as a paint. If the coat (coating film) containing an antimicrobial polymer particle is formed, on the surface of a product, it continues at a long period of time, and high antimicrobial activity can

be maintained effectively. The gestalten of the resin composition for coating may be any, such as non-solvent type coating agents, such as a granular material coating agent which comprised a particulate matter, an aqueous coating agent by which the solvent was constituted from an aqueous solvent, a solvent type coating agent by which the solvent was constituted from an organic solvent, and an ultraviolet curing type paint. The amount of the antimicrobial polymer particle used can be chosen from the wide range, for example, is solid content conversion, and is about 0.5-50 weight sections still more preferably 0.1 to 100 weight section preferably 0.01 to 200 weight section to resin 100 weight section. 1-500 micrometers of thickness of a coat (antibacterial layer) can be chosen suitably [it is desirable and] from the range of about 5-300 micrometers, for example.

[0038]The antibacterial resin composition of this invention may contain various additive agents (an antioxidant, an ultraviolet ray absorbent, a thermostabilizer, etc.), for example, stabilizer, a plasticizer, a spray for preventing static electricity, fire retardant, a dispersing agent, a surface-active agent, a bulking agent, colorant, a viscosity controlling agent, an antiseptic, an antifungal agent, a RE ** ring agent, etc.

[0039]An antibacterial resin composition (or resin composition for coating) can be prepared by mixing a solvent, an additive agent, etc. with said antimicrobial polymer particle, and resin or binder resin as occasion demands. If the gestalt of a resin composition is embraced, and and common use asks, a kneading machine, a dispersion machine, a mixer, etc. can be used for preparation of a resin composition.

[0040]A coat can be formed by optical applying the resin composition for coating to a substrate, and drying or (it is heat cure by necessity) glaring with a conventional coating method (UV irradiation etc.). As a substrate, ceramics, metal, etc. containing paper, wood, a plastic, and glass can be used.

[0041]If the antimicrobial polymer particle (antimicrobial agent) of this invention is used for coating agents, such as a paint, an antimicrobial agent can be distributed uniformly and easily, dispersion stability is high, and sedimentation etc. can be prevented from arising. Therefore, even if it is a

little antimicrobial agents, the activity of an antimicrobial agent can be revealed effectively. Since compatibility and adhesion with an organic binder are high, a coating film with a mechanical strength it is uniform and high and high transparency can be formed.

[Translation done.]